

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
1 February 2001 (01.02.2001)

PCT

(10) International Publication Number
WO 01/07325 A1

(51) International Patent Classification⁷: **B65B 47/00**

(21) International Application Number: PCT/US00/40500

(22) International Filing Date: 27 July 2000 (27.07.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/145,646 27 July 1999 (27.07.1999) US

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(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ,
DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR,
HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR,
LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ,
NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM,
TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

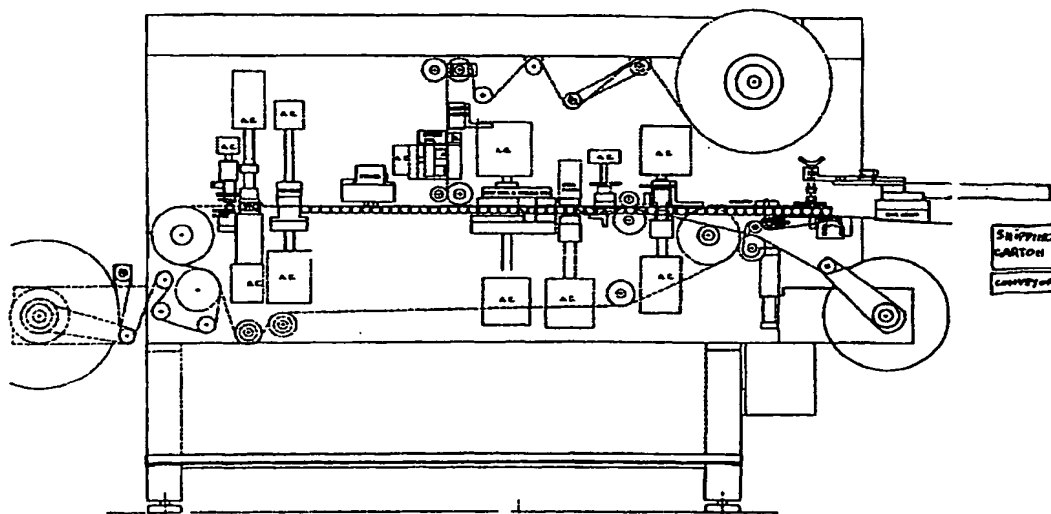
(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,
IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG,
CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

- With international search report.
- Before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments.

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: **IMPROVED COMPACT FORM-FILL-SEAL MACHINE**



(57) Abstract: A compact form-fill-seal machine capable of the high speed production, collation and loading into cartons of a variety of small dispensing packages with instant opening features including fault lines in the lower containment formation. It can make a variety of formations in the upper cover member as well as fault lines. It also produces simple cups and tubs. The machine operates at extremely high efficiency with practically every known thermoformable plastic film.

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IMPROVED COMPACT FORM - FILL - SEAL MACHINE

RELATED PATENTS

On April 11, 1989 U.S. Patent No. 4,819,406, which is hereby incorporated by reference, was issued to applicant for a Compact Form-Fill-Seal Machine for producing sealed cups and other package structures including dispenser packages for flowable substances having a fault line extending over a stress concentrating protrusion member. The stress concentrating protrusion member was formed into a relatively stiff flat upper plastic film cover member of a lower product containment member. The dispenser package being the subject of U.S. Patent Nos. 4,493,574, 4,611,715 and 4,724,982, all invented by applicant.

DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates an elevational side view of the machine of the present invention;

Fig. 2 illustrates a side elevational view of the hot score assembly, the platen contact heater assembly, the forming station assembly and the filler station;

Fig. 3a illustrates a front elevational view of the hot score assembly;

Fig. 3b illustrates a side elevational view of the hot score assembly;

Fig. 4 illustrates a side view of the platen contact heater assembly and the forming station assembly;

Fig. 5 illustrates a perspective view of the nozzle fillers;

Fig. 6 illustrates a rear view of the machine showing the forming station assembly and the filler station;

Fig. 7 illustrates a perspective view of the heat sealer die assembly;

Fig. 8a illustrates a perspective view of the longitudinal chop assembly showing tapered blades;

Fig. 8b illustrates a perspective view of the longitudinal chop assembly with tapered blades;

Fig. 8c illustrates a perspective view of the longitudinal chop assembly in a tipped over position;

Fig. 8d illustrates a top view of a clamp screw with blade;

Fig. 8e illustrates a side view of the clamp screw with blade;

Fig. 9a illustrates a side view of the transport assembly; and

Fig. 9b illustrates a side view of the transport plate.

Fig. 10 illustrates a top web forming system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A new dispenser package having significant cost and other benefits and advantages beyond those of U.S. Patent Nos. 4,493,573, 4,611,715 and 4,724,982 have been invented by the applicant and are hereby incorporated by reference which includes the stress concentrating protrusion with fault line traversing it, in the lower containment member of the new package eliminating the necessity for the costly relatively stiff flat upper plastic film cover which is replaced by a very thin, easily printed low cost, flexible membrane like film. In the view of the fact that the space about and surrounding the lower forming die was not only crowded but involved a variety of accurately controlled temperatures for thermoforming and scoring each of which must be independently maintained and isolated from the others. For example, unlike the original method of scoring the package of the upper web with a fixed blade, a more sophisticated scoring system had to be devised since the scores for each package are not necessarily straight line scores in alignment, or even in a single linear orientation with each other as would be scores made by drawing film past a fixed blade. Heated blades are embodied in this

upgraded and improved machine. The blades are maintained within a narrow temperature range. (A typical temperature might be $365^{\circ}\text{F} \pm 3^{\circ}$). These blades create score lines which are depth by increments of .0002". This is accomplished by maintaining the blades in a fixed position approximately 1/8" beneath the plane of the film to be scored.

Situated above the film and located directly over each blade is a vertically reciprocating anvil. These anvils each extend from an independent anvil adjustment mechanism (one for each blade) which in turn is mounted on a common anvil mounting bar which vertically reciprocates and which, at the bottom of its downward stroke, meets a solid stop. The anvils' stop points are each independently adjusted by its own anvil adjustment mechanism in increments of .0002" (two ten thousandths of an inch) on their down stroke to a location which after contacting the film, presses it downward to the fixed heated scoring blade and compresses the film onto the blade to the precisely controlled correct score depth.

It will be realized that the heat from the blades and the heated blade holders radiates and rises upward to the film causing problems when the machine is stopped for any period significantly greater than the normal cycling stops of the intermittent drive. This heat is accommodated in the scoring and dissipated by an automatic jet of cooling air in the lower surface of the film when the machine is stopped for purpose other than its normal intermittent indexing rest cycle.

The blades in a typical instance are oriented at a 45° angle to the axis of each package along its centerline. The need for this accuracy of depth and temperatures is that when the stress concentrator is in the containment portion of the package we are working with a heated, stretched and thus thin walled film. Mating male and female dies are generally required to produce accurately formed stress concentrators in addition to plug means. The upper plug has

an accurately machined male die mounted to it to mesh with an accurately machined female die in the lower containment forming portion of the lower forming die. The overall forming die temperature must be maintained accurately at a temperature which is warm enough to allow formation of the film yet cool enough to not create a temperature buildup, the typical range might be 165° - 175°. This is accomplished by bringing to coolant fluid to this temperature.

The use of upper and lower contact platen heaters is required all in the crowded space about the forming and scoring system. In some instances the line of packages may be increased from a single row to multiple rows, always maintaining a short index overall, relative to the width of the line of packages in order to keep the machine compact and to take advantage of the theory of a number of rapid short indexes rather than large index at slower rates as described in my U.S. Patent No. 4,819,406. In the '406 patent longitudinal slitting is accomplished by drawing the web of completely formed, filled and sealed packages through fixed blades. This was adequate when the package strength (rigidity) was supported by a relatively stiff, flat, thick upper member. In the instance of the new style package the very thin membrane like upper member supplies no strength to the packages rigidity and drawing the web of packages through those blades would cause a drag which shows up as an arc in the transverse alignment of the packages. A novel new means of slitting the package longitudinally by means of a vertically reciprocating knife holder which holds a series of longitudinally parallel oriented blades at an angle to the film plane of 20° to 30° with the lowest end at the trailing end of the package entering the punch hole at the trailing end of the package in its direction of index, during the rest period of the intermittent index cycle of the matrix of packages between advances.

Subsequent to the longitudinal slitting, a vertically reciprocating chop station makes the transverse cut during the rest period of the intermittent index cycle creating independent packages for further processing.

In a preferred embodiment the chop station has a pressure pad which compresses the packages into a supply of adhesive paper of suitable tack as to lightly hold the packages in place while being handled and loaded into a shipping case yet permitting easy peeling from the paper for end use. The paper is drawn from a roll mounted beneath the outfeed table by a suitable roll feed. The packages, now adhered to the adhesion paper are pressed downward by a flat belt indexing conveyor which compresses and advances them intermittently forward on the release coated surface of the outfeed table to the cutoff station where a flying blade transversely cuts the adhesion paper on signal to supply a sheet of collated packages.

In a further preferred embodiment the yet to be cut sheet carries forward off the outfeed table onto a "flying" carrier member which, at the instant after the transverse blade cuts the sheet of collated packages rapidly advances the sheet of collated packages to a point directly over a waiting shipping carton and at the end of its advance is sharply accelerated in the reverse direction slipping out from beneath the sheet of packages whose inertia holds it still causing it to drop vertically downward into the carton.

The smooth release coated surface of the flying carrier member may require vacuum means to hold the sheet in place on the carrier plate on which the collated sheet of packages rests. The carrier plate may be tilted with its trailing edge at the time of loading, being higher than its leading edge when it first receives the sheet of packages just prior to its initial advance to transport the sheet of package to a point directly over the shipping carton. On the first leg of its cycle the vacuum draws and holds it on the smooth release coated surface of the

carrier and the angle aids in "pushing" the package assembly forward. On the sharp accelerated return the vacuum is released and the carrier plate tends to instantly draw away from the sheet of packages because of its sloped configuration.

It may also be seen that the top web may also be formed. (Fig. 10)

CLAIMS

1. A machine capable of automatic continuous high speed production of formed, filled, sealed packages comprising:

drive means to intermittently advance a pair of parallel transport chains having means to secure and pull bottom web material from an intermittently braked roll of web of thermoformable plastic to advance it,

said transport chains advancing bottom web material past a series of stations, said series comprising:

a scoring station where said web is accurately scored;

a heating station where said web is controllably heated to thermoforming temperatures;

a forming station where said heated web is formed, said forming station including forming die means which can form a series of spaced pocket formations encompassed by a flat unformed web;

a filler station, said filler station including means for filling each said pocket formation with an equal amount of a product supplied to said filler station; and

driven roller means intermittently advancing a top web material in timed relationship with the intermittent advance of said bottom web member with each pocket formation,

said driven roller means transporting said top web in substantially parallel, closely adjacent proximity to and above said bottom webs filled pocket formations to a sealing station where top web is sealed to bottom web,

said transport chains next advancing said sealed bottom web and top web combination to a further series of stations comprising:

a punch station, which punches shaped apertures in the unformed sealed web areas which rim said pocket formations transversals in a straight line with a punched hole at each end of the line of pocket formations and one between each pocket formation;

a longitudinal cutting station to longitudinally shear the films in a cut which travels between said punched holes to create longitudinal rims along said pocket formations; and

a transverse cutting station which transversely slits the sealed areas between said pocket formation to completely separate said pocket formations and creating transverse rims to produce individual generally rectangular finished packages with sealed rims and punched corners.

2. The machine of Claim 1, where said generally rectangular packages with sealed rims are collated by collation means comprising:

a lightly adhesive collation paper intermittently advanced about an idler roller just beyond and parallel to the transverse cutting means; and

a pressure pad mounted on a vertically reciprocating transverse cutting means which on its downward stroke compresses a row of the individual finished packages onto the adhesive side of the paper which row is then indexed forward for the next cycle by indexing

means comprised of a high friction indexing belt conveyor under the collation paper with an adjustable floating pressure plate lightly pressing downward on said individual finished packages to aid the friction belt in drawing the collation paper forward as well as to further insure said packages adhesion to the collation paper to create a continuous sheet of collated packages,

said continuous sheet of collated packages having been advanced onto a flying carrier plate member with vacuum means to maintain the sheet in place on said carrier plate member which is attached to a high speed pneumatic transport platform, a flying blade attached to another high speed transverse transport platform on signal instantly slits the collation paper between said packages alongside the trailing edge of said flying blade into an individual sheet resting on said flying carrier plate;

upon completion of the advance of each slit sheet onto said carrier plate said plate, on signal, immediately transports said sheet of packages to a point directly over a waiting shipping carton, and said transport platform on reaching said point, on signal, instantly reverses with sharp acceleration and simultaneous with a vacuum release moves sharply out from under the sheet whereupon said sheet, due to its inertia, is left in mid air to drop into the carton.

3. The machine of Claim 2, which said vacuum carrier plate member is tilted with its leading edge lower than its trailing edge.

4. The machine of Claim 1, where the means to secure and pull bottom web material by the pair of web transport chains comprises a series of upstanding pin members mounted on said chains and impaler means to impale said web material on said pins along each to its lateral edges.

5. The machine of Claim 4, where said scoring station comprises vertically reciprocating micrometer adjustable anvils and controllably heated scoring blades where said web is scored by said anvils compressing said web against said heated scoring blades to a controllably accurate depth during the rest period of the intermittent cycling.

6. The machine of Claim 5, where said heating station comprises upper and lower vertically reciprocating contact platens which compress said web between said platens to controllably heat said web to necessary temperatures for thermoforming.

7. The machine of Claim 6, where said controllably heated web is formed by forming means including at least one of the following vacuum means, air pressure means, forming die means, plug assist means capable of including integral male die means to mate with female die means in the lower forming die, capable of at least one of the following, vacuum forming, air pressure forming, plug and die forming, and forming a series of pocket formations having integral stress concentrator means.

8. The machine of Claim 7, where said top web can be made to register print with each pocket formation on signal picked up from said web.

9. The machine of Claim 8, where said sealing station comprises vertically reciprocating upper and lower heat sealing dies controllably heated and chill dies to quickly cool and set seals.

10. The machine of Claim 9, where said punch station comprises series of male and female punch die sets punch the sealed upper and lower web to create corners and vacuum means to remove the punched out plastic bits.

11. The machine of Claim 10, where said longitudinal cutting station comprises a vertically reciprocating longitudinal chop member containing a series of angled blades which on traveling vertically downward enter the row of the punched holes during the rest cycle of the intermittent index of the formed, filled connected packages and to longitudinally shear the films in a cut which travels between the punched holes.

12. The machine of Claim 11, where said transverse cutting means comprise a slotted transverse anvil and a transverse blade holder with angled blades mounted on it, both reciprocating vertically toward and away from each other to allow said fully made and filled packages to index between them when they are apart, said angled blades so aligned that said blades enter said slot on their downward stroke after passing through the unformed web portions between packages to be cut through, stripper means to prevent the packages from lifting up when the blades are withdrawn.

13. The machine of Claim 1, with a forming station so mounted as to heat and form the top web.

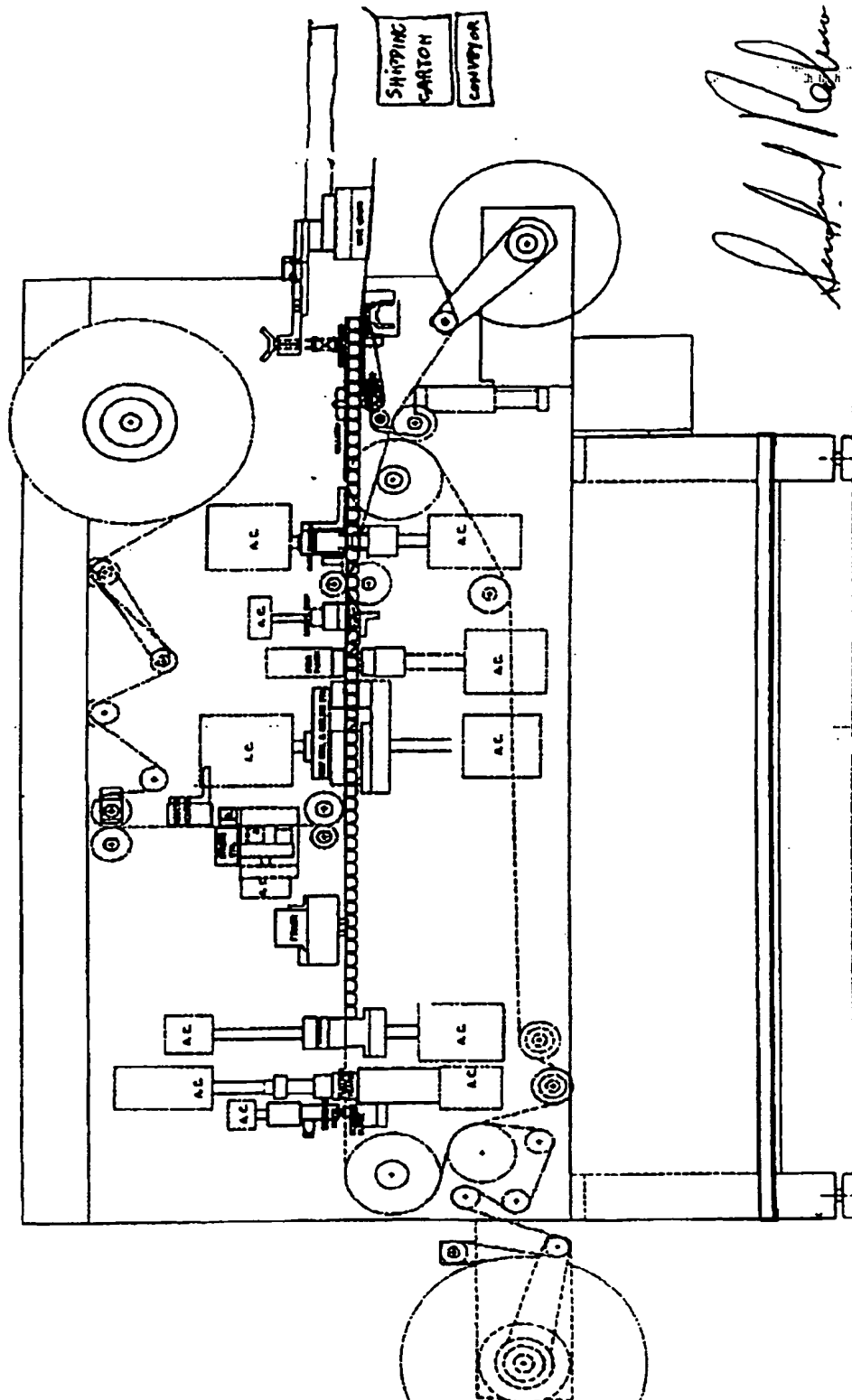
14. The machine of Claim 13, where said forming stations comprises,
a pair of mounting members with at least one member reciprocating;
a preheating platen system mounted on with reciprocal members of the
platen system mounted on each mounting member; and

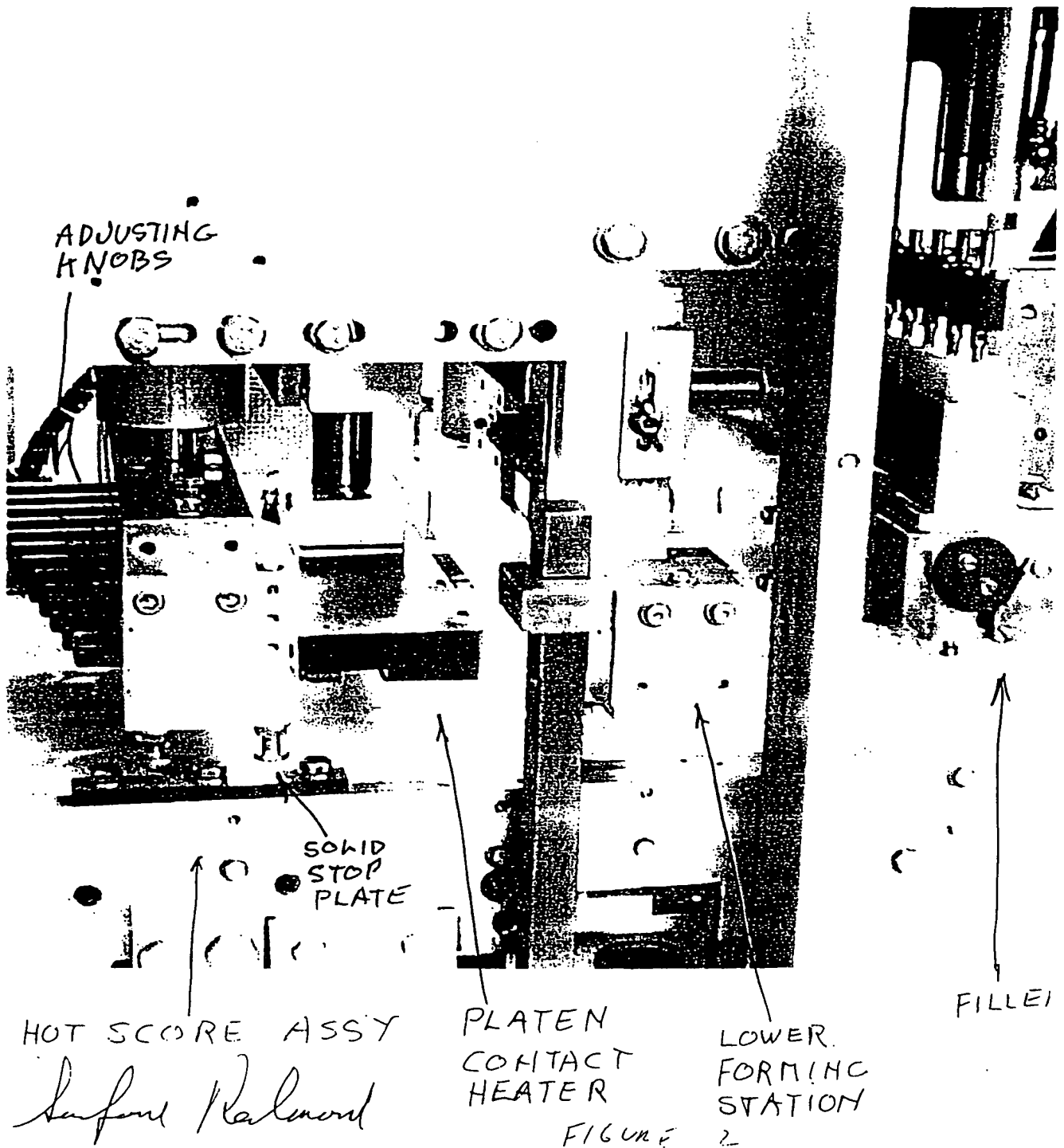
forming die system with reciprocal members mounted on each mounting member.

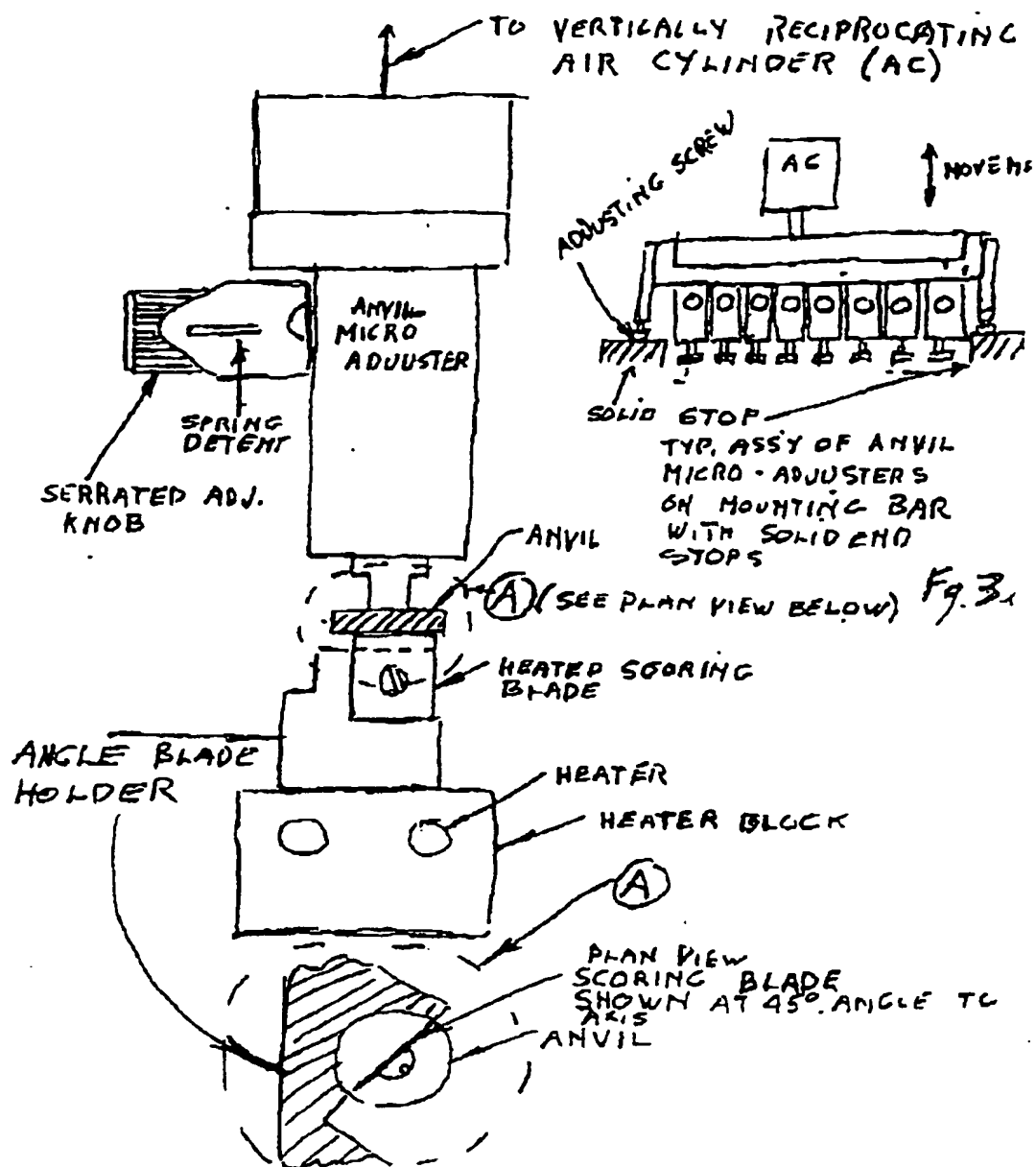
15. The machine of Claim 14, where said mounting members contain hot scoring capabilities comprising:

a series of heating scoring blades mounted in blade holders driven against micrometer adjustable anvils so as to score the web indexing between the mounting members when the web is at rest and the mounting members are reciprocating.

16. The machine of Claim 13, with a forming station so mounted as to heat and form the top web.







SCORING STATION

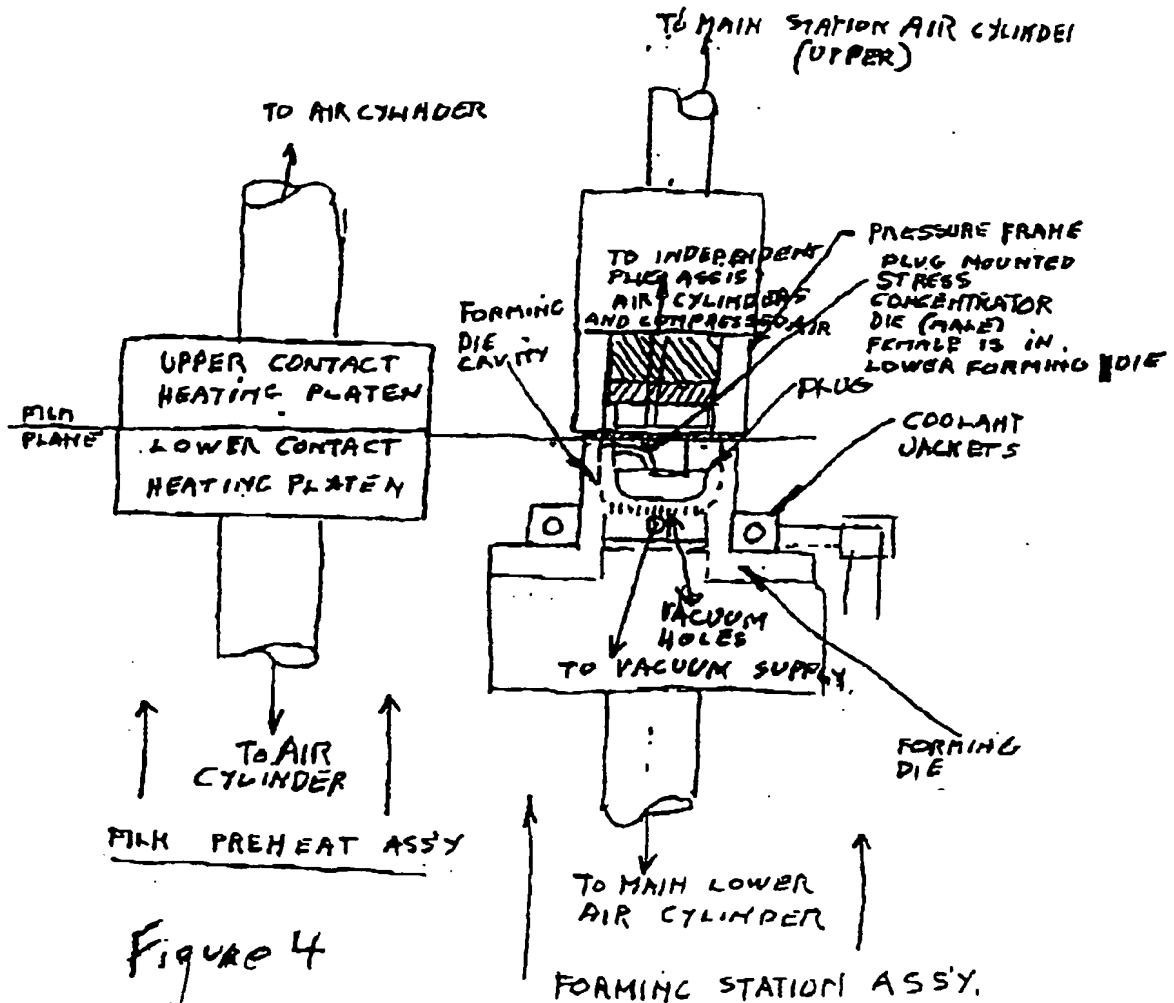
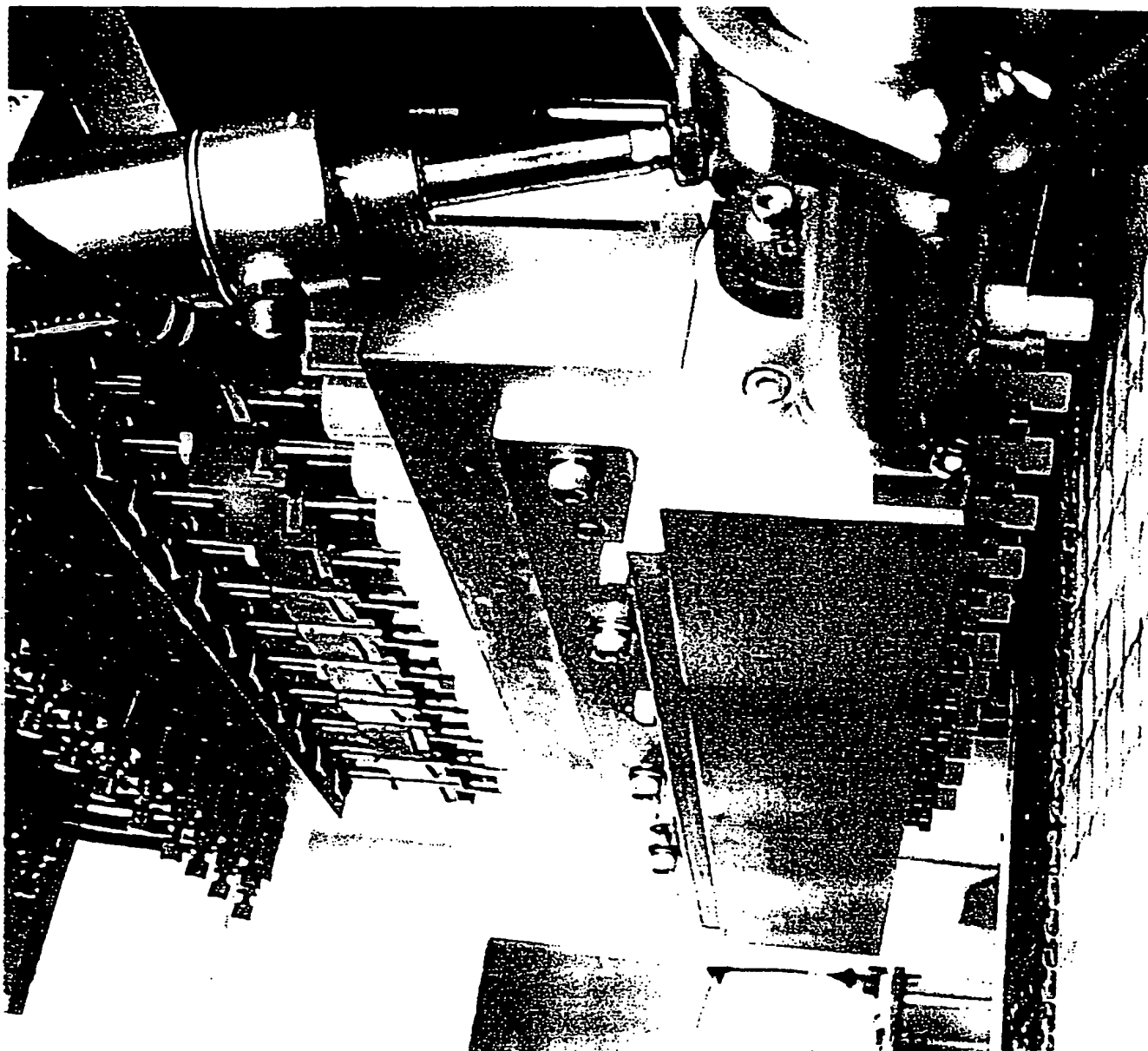
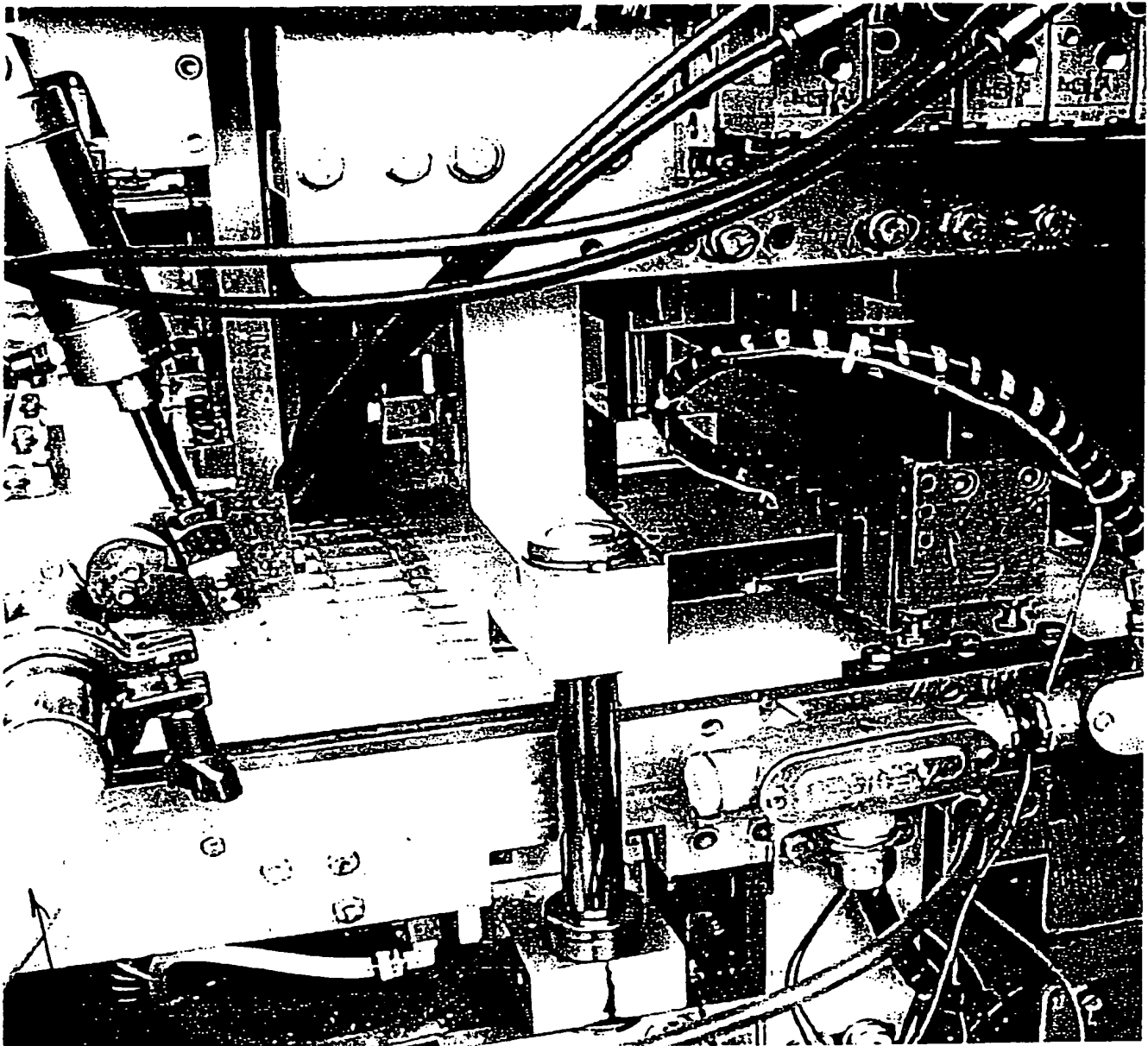


Figure 4
LOWER WEBFORMING STATION



IR NOZZLE
FILLER

Sufant Redmond

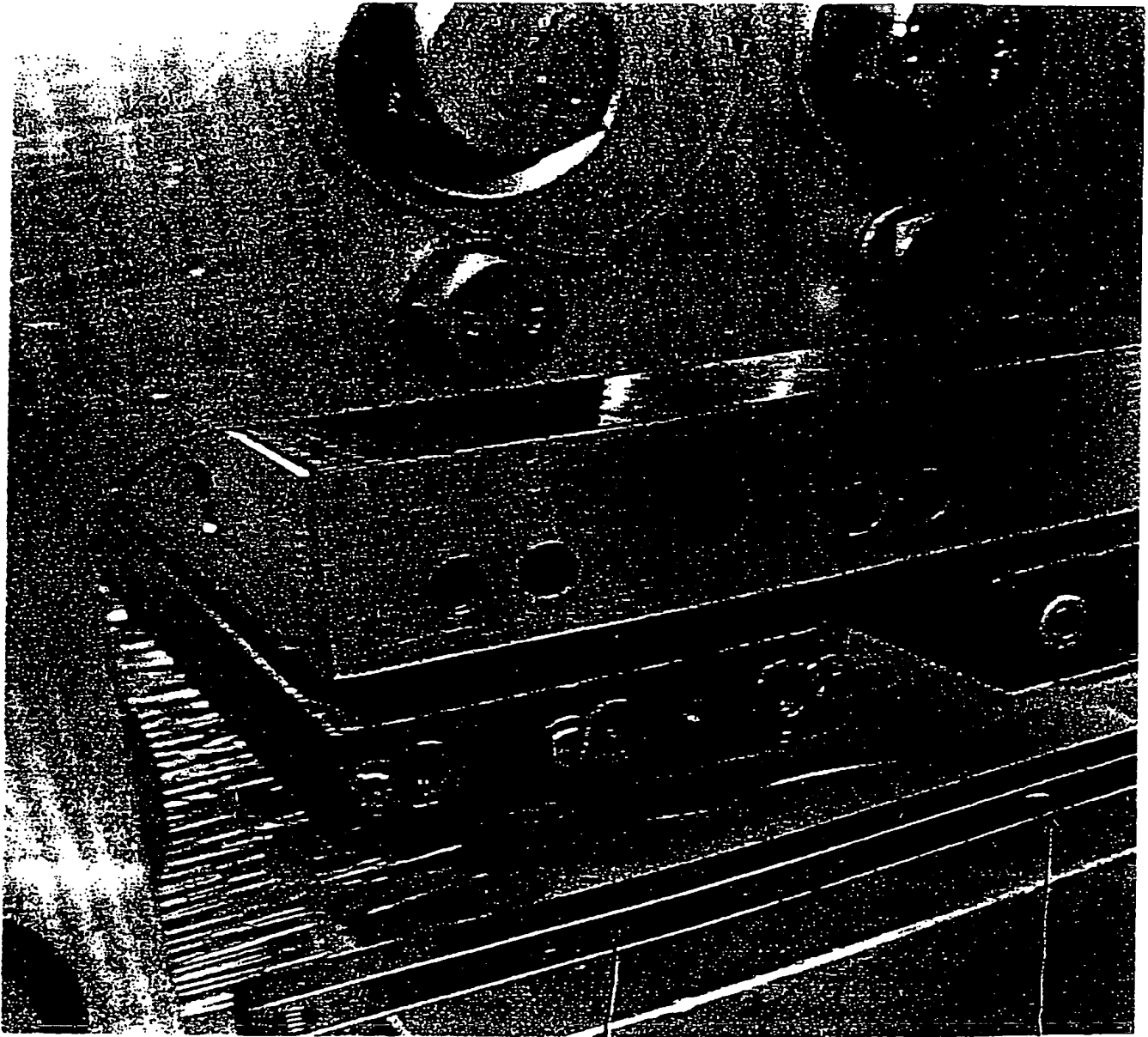


PRODUCT SUPPLY
TO FILLER.

REAR VIEW OF MACHINE

FIGURE 6

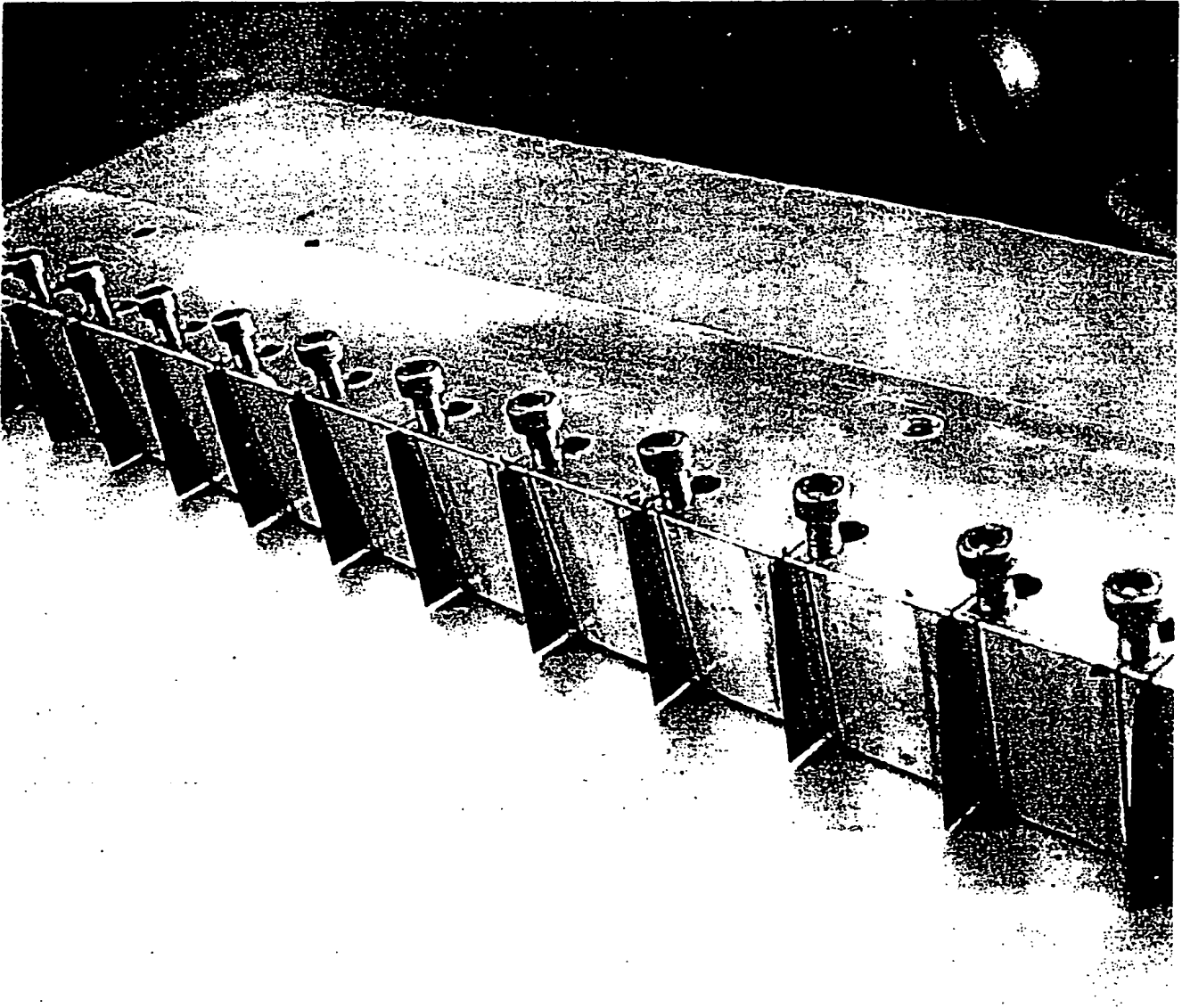
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HEAT SEALER DIE

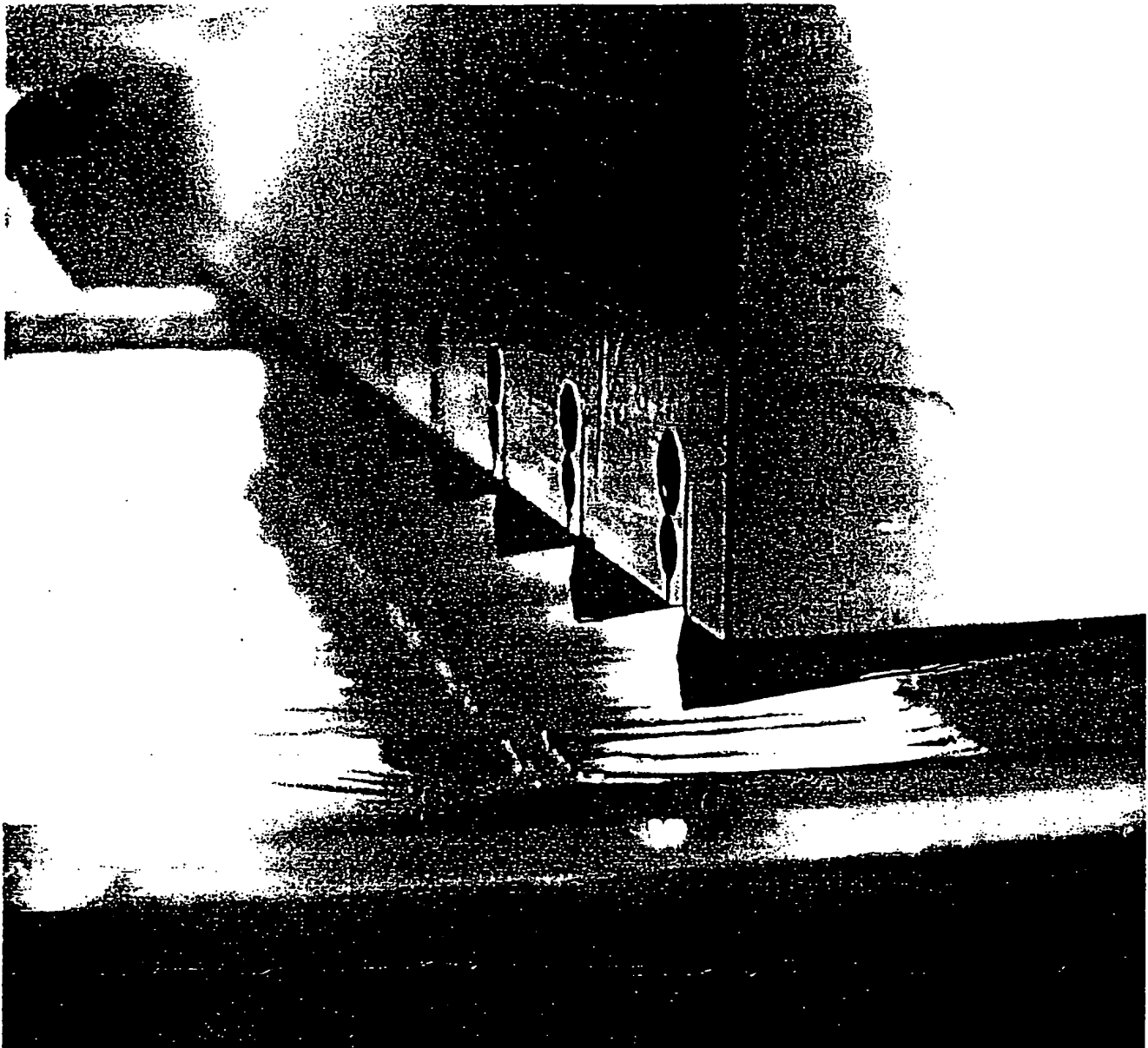
CHILL
DIE

Suford Redmond · Fig. 7



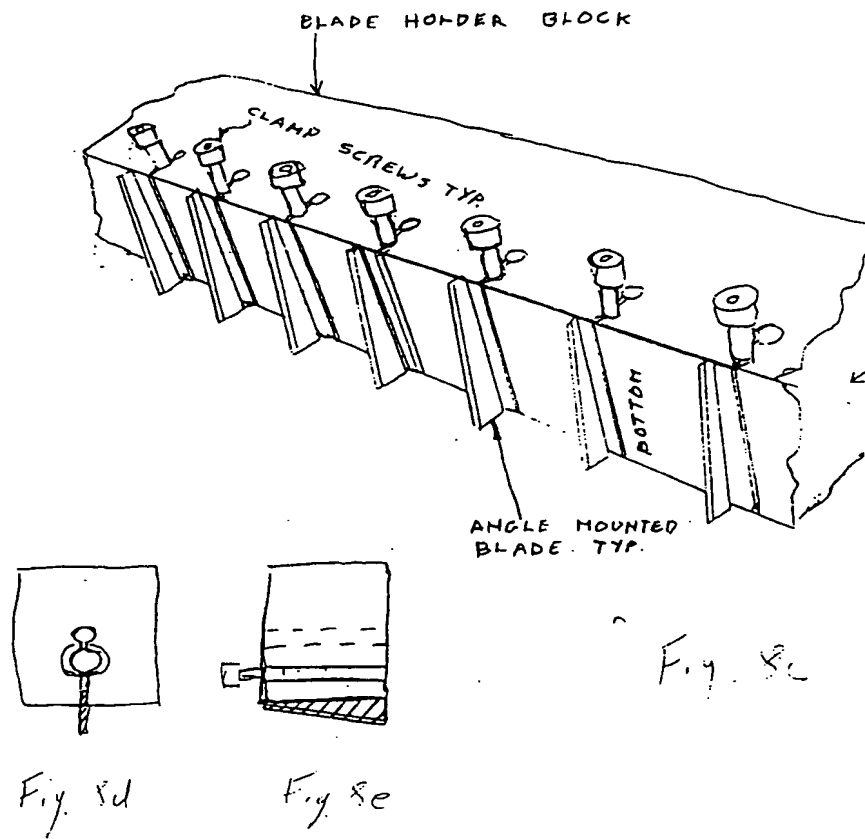
Robert Palmer
Fig. 8a

LONGITUDINAL
CHOP ASSY
SHOWING TAPERED
BLADES



LONGITUDINAL CHOP
WITH TAPERED BLADES.
Suford Redmond. 85

LONGITUDINAL SLITTING ASSEMBLY
VIEWED IN TIPPED OVER POSITION



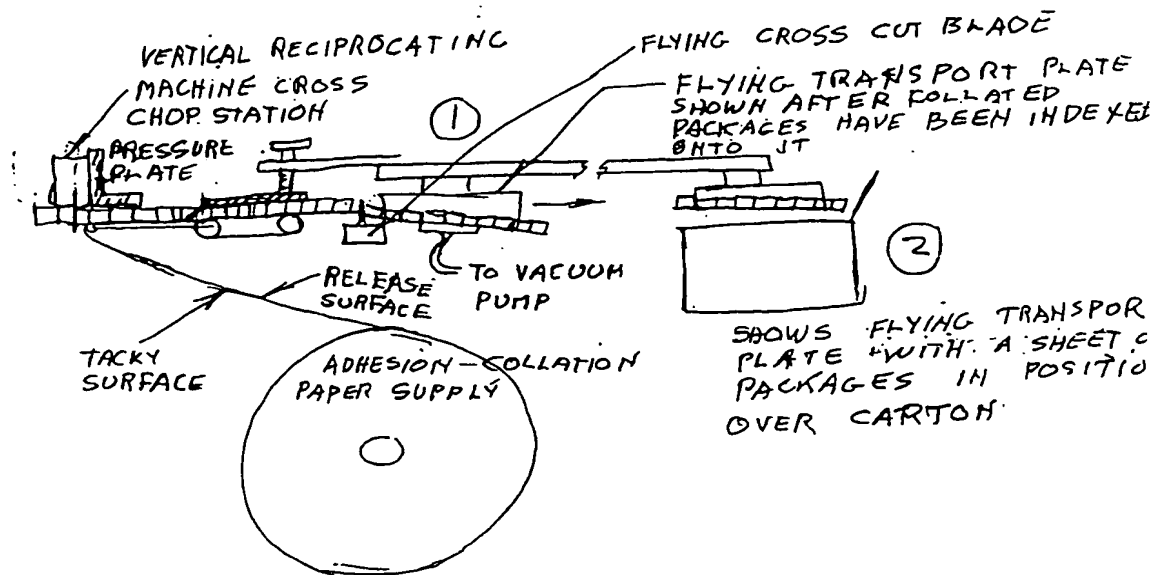
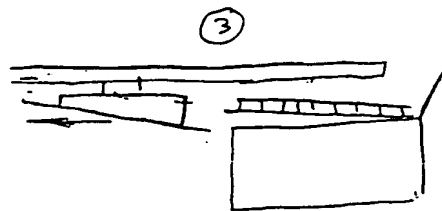
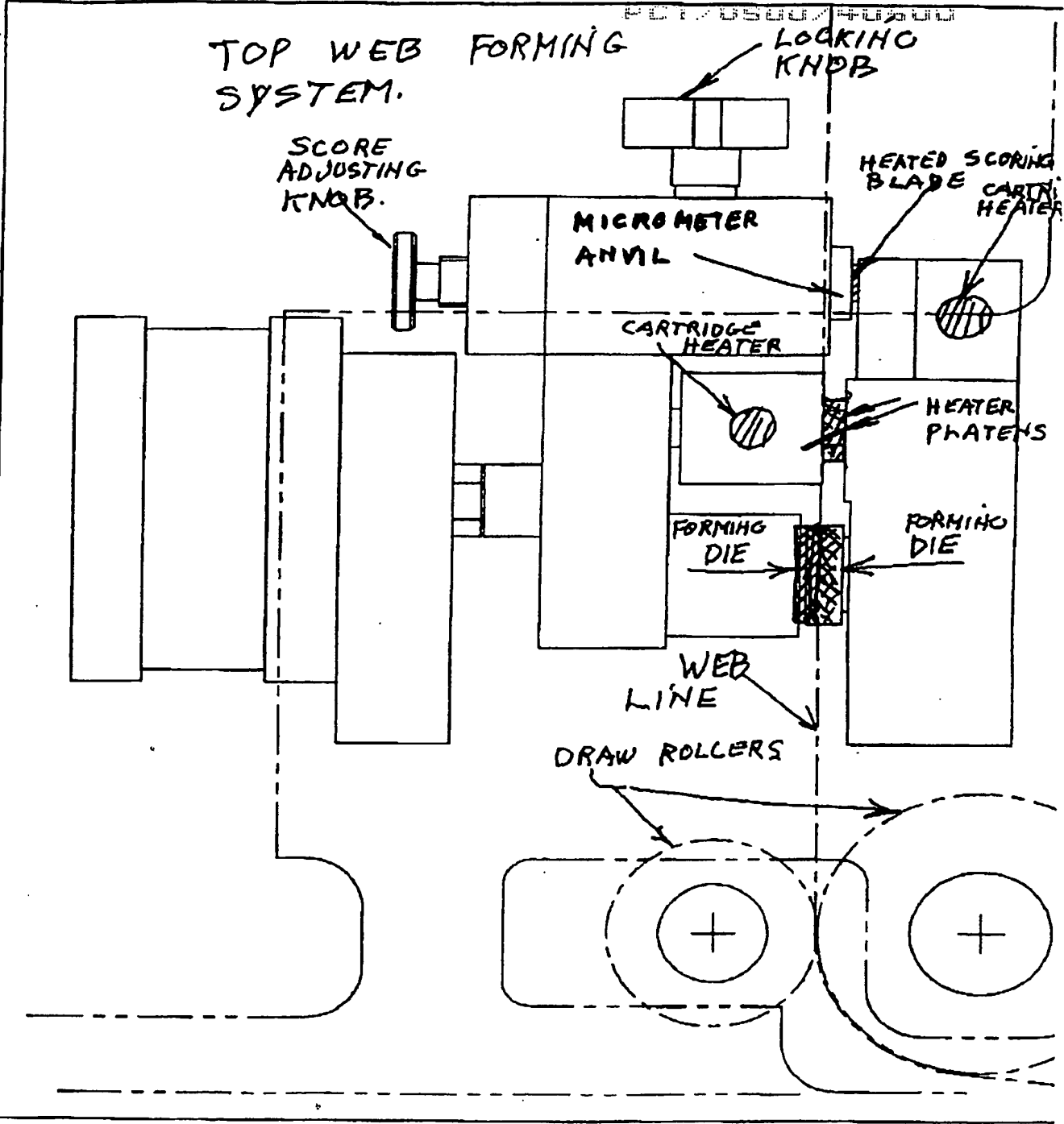


Fig. 9a



SHOWS TRANSPORT PLATE RETURNING TO LOADING POSITION AFTER HAVING BEEN SHARPLY ACCELERATED AND SLIPPED OUT FROM BENEATH THE COLLATED SHEET OF PACKAGES WITH PACKAGES IN A FREE FALL INTO CARTON.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/40500

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B65B 47/00
US CL : 53/559, 561

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 53/559, 561, 548, 555, 306, 329.4, 373.7, 375.7; 206/538, 820

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
None

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
None

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,819,406 A (Redmond) 11 April 1989, entire document	1-16
Y, P	US 6,085,942 A (Redmond) 11 July 2000, Figure 1.	1-16
Y	US 5,364,484 A (Redmond) 15 November 1994, entire document.	2-3
Y	US 5,358,118 A (Thompson et al.) 25 October 1994, column 4, lines 50-54, Figure 3.	1-16
Y	US 5,682,729 A (Buchko) 04 November 1997, entire document.	1
Y	US 5,517,805 A (Epstein) 21 May 1996, entire document.	1
Y	US 5,477,660 A (Smith) 26 December 1995, Figures 1-11.	1

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

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Date of the actual completion of the international search

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